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Comparative study of two varieties of rice (FARO 44 and FARO 60) on growth performance of African catfish (*Clarias gariepinus*) in fish cum rice integrated system

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Abstract
This study was carried out to investigate the effect of integrating fish with different rice varieties in order to determine the most effective variety on growth performance of *Clarias gariepinus.* The experiment was carried out at the Integrated Fish Farm of National Institute for Freshwater Fisheries Research, New Bussa. The experiment involves three treatments (Rice sp. faro 45 + fish as Treatment 1, Rice sp. Faro 60 + fish as Treatment 2 and Fish only as Treatment 3 which serve as control). The result showed that in most of the growth performance parameters observed, Treatment 2 had the highest values and was significantly different from other treatments, which therefore, means that Rice Faro 60 is recommended to be used in fish cum rice integration for proper growth and yield of African catfish.

Keywords: African catfish, *Clarias gariepinus*, Rice, Faro 45, Faro 60, integrated system

1. Introduction
Rice is a globally important food crop, with diversified varieties grown on 157 million ha worldwide in a wide range of ecological conditions and water regimes. It forms the staple food for over half of the world's population with an annual production in 2007 of 652 million t. Rice-fish culture, which means the concurrent culture of rice and fish, is one of the best options for increasing food production from limited land through ecological agriculture [1, 2]. Integrated fish farming refers to the coordinated growing of crops as well as rearing of fish in the same plot. This could also involve the rearing of animals and fish. The most commonly known integrated systems of farming are expressed in terms of "Fish-Cum"; meaning "Fish and" others as the case may be [3]. Benefits of rice-fish culture go beyond producing additional fish in the paddy field. It is believed that the fish control weeds and pests in the paddy fields, allowing integrated pest management (IPM), and there is a fertilizing effect from the fish excrement, which increases the nutrient availability to the rice crop [1, 4, 5].
Paddy *cum* fish farming gives the ability to utilize fully available resources. It can also serve as an off-season occupation for farmer and boost productivity and income earning for the farmer. Fish also serve as an excellent agent for integrated pest and weed management. Fish culture in paddy fields gives increased soil productivity and boosts the production of paddies by reduction in the cost of fish production. The recycling of nutrients by the fish through feeding and depositing feaces in the soil increases the uptake of nutrients, such as phosphorus and nitrogen by the rice. It increases rice yields and income from the production of both rice and fish while reducing the use of fertilizers. It can also act as a reliable source of protein for farmers and their families, countering the decrease in available wild fish in many countries [6]. [7] reported that lack of experimental approach to integrated aquaculture projects and the choice of suitable species combinations are the major problems of Rice-cum-fish culture in rice fields in Nigeria. A 2003 report on potentials of rice production in Nigeria revealed that virtually all the states in Nigeria have records of rice production However, Adamawa, Benue, Borno, Kaduna, Kano, Niger and Taraba states (just about seven states out of the thirty-three) make up 50% of the total area of rice cultivation in the country. In Nigeria, Integrated farming is practiced either as capture or traditional method or as culture method [7]. In polyculture, fast growing compatible fish species are grown together in rice fields to increase total production

of both commodities form the same body of water and land. This has long been practiced in China, India and Israel especially with crop, Tilapia and Millets [8]. Poverty can be alleviated through food security by adopting sustainable systems (land and water use) for increased rice and fish production. This situation poses the challenge of finding adoptable technologies for improved utilization of land and water resources for fish and rice production simultaneously [9]. This work is therefore, aimed at integrating fish with rice in order to determine the most effective variety of rice on growth performance of fish

2. Materials and Methods

The experiment was carried out at the integrated fish farm site of National Institute for Freshwater Fisheries Research (NIFFR), New Bussa,

2.1 Ponds

Nine earthen experimental fish ponds were used for the experiment, three for each treatment. Each of the integrated fish pond measures 10m x 10m, with dug trenches of 2m along its shores.

2.2 Stocking

The experiment involves three treatments, T1 – T3 (Rice sp. faro 45 + fish as Treatment 1, Rice sp. Faro 60 + fish as Treatment 2 and Fish only as Treatment 3 which serve as control). Each treatment was replicated three times. 100 fingerlings of *Clarias gariepinus* were stocked into each experimental pond.

2.3 Sampling

Sampling was carried out every two weeks, where total length and weights were measured for each treatment in order to determine the following growth performance parameters;
MWG = Final weight – Initial weight
FCR = Total feed intake/MWG

$$SGR = \frac{LnFinalweight - LnInitialweight}{t} x\ 100$$

$$PWG = \frac{Weightgain}{Initialweight} x\ 100$$

$$SR = \frac{Total\ number\ of\ fish\ at\ harvest}{Total\ number\ of\ fish\ at\ stocking} x\ 100$$

2.4 Water Quality Monitoring

Water quality parameters; dissolved oxygen (D.O), conductivity, pH and temperature were also monitored during the experiment.

3. Results

The water quality parameters recorded in this experiment fall within the recommended range for the culture of African catfish *Clarias gariepinus*, as shown in table 1 below.

Table 1: Water quality parameters during the research

Treatments	Surface Temp (^{0}c)	Air Temp (^{0}c)	PH	Dissolve oxygen (DO)(µg/l)	Conductivity (µo/cm)
T1	28.4	27.9	7.2	6.0	122
T2	28.2	27.5	7.2	6.2	100
T3	28.2	27.7	7.4	5.8	220

Table 2: Growth performance of *Clarias gariepinus* stocked in fish-cum-rice integrated system

Parameters	Treatments		
	T1	T2	T3
Initial weight (g)	7.50±0.20^a	6.60±0.50^b	5.00±0.10^a
Final weight (g)	300.00±20.00^b	400.00±10.00^a	280.00±9.20^b
MWG (g)	292.50±19.8^b	393.40±9.5^a	275.00±9.10^b
FCR	0.51±0.02^b	0.59±0.01^a	0.51±0.01^b
SGR	8.11±0.09^b	8.54±0.03^a	8.02±0.05^b
PWG	3897.15±160.32^b	5976.23±309.69^a	5499.03±72.03^b
SR	80.00±7.0^a	84.00±1.00^a	70.00±10.00^a

Note: means with the same superscripts on the same row are not significantly different (p>0.05)

The result of the experiment (Table 2) showed that the highest final mean weight was recorded in treatment 2 with a value of 400.00 which is significantly different (p<0.05) from the other treatments. However, there was no significant difference between treatments 1 and 3 with mean value of 300.00 and 280.00 respectively. FCR was observed to be highest and significantly different in Treatment 2 with a mean value of 0.59. There was significant difference between the treatments in terms of SGR were treatment 2 had the highest value while treatment 1 and 3 did not produce significantly different values. Similarly, no significant difference exists between treatments 2 and 3 in terms of PWG but treatment 1 exhibit the highest value and was significantly different from the other treatments. Survival rate was observed to be highest in treatment 2 and was significantly different from the other treatments.

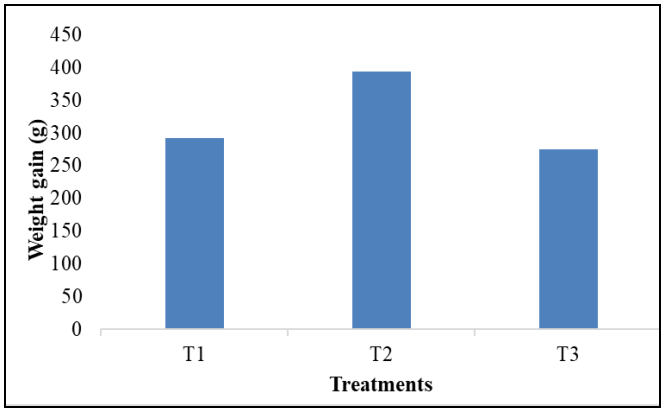

Fig 1: Mean weight gain of *C. gariepinus* recorded in fish-cum-rice integration

Figure 1 shows the trend on weight gained by the fish at the end of the experiment indicating that Treatment 2 had the highest mean weight gain followed by Treatment 1 with the least mean weight gain recorded for Treatment 3

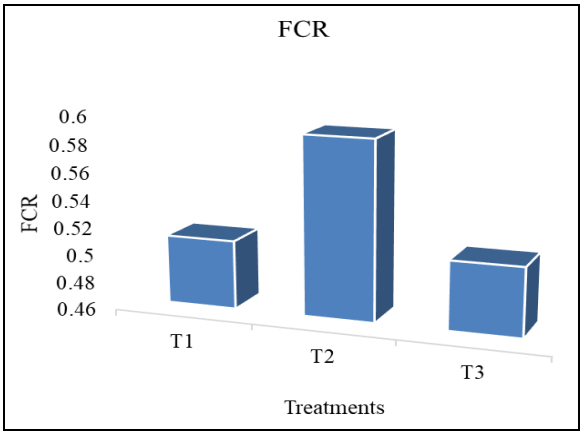

Fig 2: Feed Conversion Ratio of *C. gariepinus* recorded in fish-cum-rice integration

In Figure 2 the trend shows that at the end of the experiment, Treatment 2 had the highest mean FCR while Treatment 3 and Treatment 1 did not differ significantly in terms of mean FCR recorded at the end of the experiment.

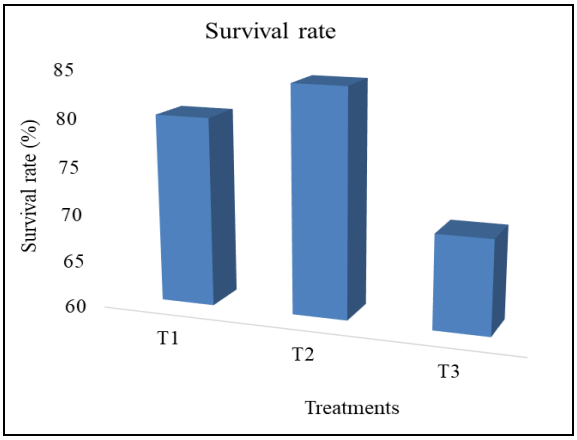

Fig 3: Survival rate of *C. gariepinus* recorded in fish-cum-rice integration

Figure 3 shows the highest percentage survival trend indicating that Treatment 2 recorded the highest value followed closely by Treatment 1 while the least survival was recorded for Treatment 3

Plate 1: Integrated fish cum rice pond

4. Discussion

The physico-chemical parameters of water are important to the growth, productivity and survival of aquatic organisms especially fish as they play a vital role in the biology and physiology of the fish [10]. According to [11], the best temperature range for optimum production of *Clarias* species is 25 – 31° C, as such the water quality parameters recorded in this experiment fall within the recommended range for the culture of African catfish *Clarias gariepinus.*

In all the growth performance parameters for the fish, the result showed that treatment 2 performed better than the other treatments which may be due to the effect of the species of the rice used (Faro 60) in the integration as against the other species of rice (Faro 44) used in treatment 1 and treatment 3 with no integration respectively. In an integrated production system, micro-biological activities are higher, the ecosystem is gradually boosted which improves and enhances the micro-biological activities in the pond for both fish and rice growth. This is practical as the oxygen gas expelled by the plant is absorbed by the fish and the carbon II oxide gas expelled by the fish is used up by the crop in the pond [12]. A well-managed fish-cum-crop integration is a self-sufficient system, due to the fact that in Fish-cum-crop integration increases the number of feed and fertilizer sources is relatively stable; the cost could be reduced by one third and the quality of feed and fertilizer is very high. In addition, the energy consumed in transporting and purchasing feeds and fertilizer could be reduced [13]. The input of labour varies greatly. In the slack season, excess labour can

be used for crop production. This provides more job and increases income [14]. Also, pond silt can

be directly used as base manure for fodder crops. Pond silt is safe manure. The amount applied is not necessarily limited. This method is beneficial to the release and diffusion of nutritional elements. It also improves the dissolved oxygen content of the base layer of water [15].

5. Conclusion

The finding from the experiment shows that the integration of fish with rice is a viable integration technology that will increase fish growth beyond the growth level that will be achieved if the fish is cultured un-integrated. This technology is therefore handy for medium to large scale rice farmers to integrate the fish culture in their paddy fields. And based on the findings of this study therefore, Rice Faro 60 is recommended to be used in fish cum rice integration for proper growth and yield of African catfish.

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